Low-Isentrope, High-Efficiency Heavy Ion Direct Drive Capsule Simulations

by

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We build upon recent work [1] that presented simulations of heavy ion beams' passive range lengthening in directly-driven DT targets by now raising the ion energy over the course of the drive to follow the ablation front inward. We have scaled the target from ref. [1] to reactor grade and have chosen a higher-energy driving ion species to reduce beam perveances. While an arbitrarily strong shock cannot compress the fuel by more than a finite factor (4X in a perfect monatomic gas), there is no bound on the entropy it can add. We present 1-D implosion calculations that demonstrate the approach to adiabatic compression with an increasing number of shocks tailored to keep the fuel nearly Fermi degenerate. We have studied capsule performance using either two discrete ion beam energies or a steadily ramped main pulse energy. These simulations show that a linear energy ramp reduces heating of the fuel early in the main pulse and improves coupling as ablated plasma accumulates. [1] B. G. Logan, L. J. Perkins, and J. J. Barnard, \emph{Phys. Plasmas} \textbf{15}, 072701 (2008).

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